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ABSTRACT

To investigate the use of a self-monitoring activity as a method of promoting generalization of a target speech sound to nontraining conditions, 40 children (grades 2-7) with articulation impairments (sound substitutions) attended individual or small group speech therapy sessions. Self-monitoring activity focused on the child recording correct sounds immediately following correct sound production. Analysis of the children's generalization to their natural environments revealed that all of the Ss demonstrated increases in the use of the target sound outside the clinical environment. Ss consistently used the correct sound 90% to 100% of the time and continued to use the target sound correctly following termination of recordkeeping. A replication study was performed which showed at least measurable improvements in 27 children. Study recommendations included increased involvement of therapy clients in their own therapy programs. (CL)

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Programming Rapid Treatment Gains in Designated Instructional Services for Speech Impaired Children

Lynn Kern Koegel, M.A., CCC-SP and

Robert L. Koegel, Ph.D.

Prepared for
The Office of Special Education
California State Dpeartment of Education

July, 1984

FINAL REPORT

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Programming Rapid Treatment Gains in Designated Instructional Services for Speech Impaired Children

Lynn Kern Koegel, M.A., CCC-SP and
Robert L. Koegel, Ph.D.

Prepared for
California State Department of Education
Special Needs Division
721 Capitol Mall
Sacramento, California 95814

Speech and Hearing Department
Snidecor Hall
University of California
Santa Barbara, California 93106

July, 1984

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Forward

The purpose of this report is to present a method for increasing generalization and thus decreasing the amount of time a child is enrolled in speech services for articulation. The methods discussed in this report are data based and have been field-tested by several different speech-language pathologists.

The authors would like to express sincere appreciation to Mary O'Dell, M.A., speech-language pathologist for the Rio Unified School District; Jan Shiells, M.A., CCC-SP, speech-language pathologist for the Carpinteria Unified School District; Maureen Kamino, M.A., speech-language pathologist for the Carpinteria Unified School District; Kirsten Slack, M.A., CCC-SP, speech-language pathologist for the Oceanview School District, and Beth Wile, student teacher for the Carpinteria Unified School District. All of these people assisted in the field-testing of this project and offered numerous comments throughout the course of the study. In addition the authors would like to thank Jan Costello, Ph.D., UCSB; Diane Gilchrist, M.A., CCC-SP, UCSB; Gini Smith, UCSB; and Shelly Greenbaum, M.A., CCC-SP, Scottish Rite Institute, Santa Barbara, for their invaluable comments during the preparation of this report.

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EXECUTIVE SUMMARY

Introduction

The purpose of this project was to investigate the use of a self-monitoring activity as a method of promoting generalization of a target speech sound to nontraining conditions. Forty children who substituted θ/s and ð/z and/or w/r participated in this study. The children attended speech, individually or in small groups, twice weekly for 15 to 20-min sessions throughout the entire study. The investigation was conducted in the context of a multiple baseline research design replicated across subjects and behaviors. The results demonstrated that when the self-monitoring activity was implemented, the children began to generalize the use of the correct speech sound to their spontaneous speech, outside of the clinical setting where training took place.

METHOD

Subjects

Forty children, between second and seventh grade (at the start of treatment) participated in this study. The children attended twelve different schools and were enrolled in special education for speech (the children were not enrolled in any other special education services). The children all demonstrated consistent misarticulations on one to three phonemes.

Assessment consisted of briefly talking to the children outside of their classroom for 5 to 10 minutes during the first two weeks of school. Children who evidenced consistent (at least 90%) misarticulations were eligible for participation in this study. Speech was implemented in a room which was different from the child's regular classroom, by the school district's Speech-Language Pathologist.

Design

Data were collected in a multiple baseline design (cf. Hersen & Barlow, 1976) across children and across sounds for two children. This design allows each child to serve as a control for the child(ren) who have begun the experimental phase. This design turned out to be extremely practical for applied research in a public school setting since all children ended up receiving the most effective treatment, in a systematically controlled evaluation format.

Measurement

Because the experimental question in this project concerned generalization, all data points represent systematic generalization probes. That is, the dependent variable (percent of correct articulatory responses) was an independent measurement which was taken throughout the entire study. These data were taken both during the baseline condition, which consisted of the treatment without self-monitoring activities, and during the self-monitoring condition. Two observers, naive to the experimental condition, independently recorded the children's correct/incorrect productions during the children's speech. The observers were speech and hearing students who had completed a minimum of one course in phonetic transcription.

In order to obtain as valid a generalization measure as possible, this project collected data in the children's natural environments. Prior to the data recording probes, each child's teacher was introduced to the data recorders. The purpose of the measurement was explained to the teacher (but the teachers were not told how long the baseline measures would be for any given child). The teachers were told that the recorders would make monthly checks. In addition, they were asked to introduce the data recorder as a new aide in the school who wanted some

information about the school and wanted to meet some of the students. Therefore, it was hoped that the possibility would decrease that the children would make an association between the data recorder and their speech. Thus the data could be taken in a less clinical manner.

In order to obtain data during the child's unstructured spontaneous conversation, the data recorder engaged in a conversation with each child. During each of the child's responses, the first occurrence of the target phoneme in the child's answer was recorded as correct or incorrect. That is, the recorder made an utterance or asked a question, then the first target phoneme in the child's next response was recorded. Then, the recorder made a second utterance or asked a second question and the first occurrence of the target phoneme in the child's second response was recorded for the second response, and so on until ten responses were recorded. In instances where the target phoneme did not occur (such as if the child simply answered "no") that particular trial was disregarded. In order to record the responses unobtrusively, the data recorders covertly utilized each finger to represent a question. That is, the data recorders unobtrusively held their fingers in such a way (e.g., bent or straight) that they could later distinguish between the correct vs. incorrect responses. Then, immediately following the conversation, the responses were recorded on a precoded data sheet.

Baseline - Treatment Without Self-Monitoring Activities

As mentioned above, the baseline consisted of the treatment program without any self-monitoring activities for varying lengths of time. (See below for detailed program steps). Following the steps listed below, the first group of children began the self-monitoring program. The children who did not enter the self-monitoring phase continued in the speech therapy program as follows without any self-monitoring activities.

First, in the clinic room each child practiced the target sound in two sentences. Next, each child practiced the target sound in a variety of drills that required short responses from the child (e.g., describing a picture). At this point, as a control for practice outside of the clinic, speech drills were sent home for the parents to work on with some of the children. Finally, each child practiced the target sound in unstructured conversation.

Some of the children have extremely long baselines. These children were enrolled in speech services prior to the development of this specific self-monitoring treatment but had shown no gains outside of the speech therapy environment. After the program was developed all of the children continued in the baseline (treatment without self-monitoring) but no child remained in this speech program longer than four more months prior to starting the self-monitoring activity. Since no children showed any gains in this condition it seemed unethical to continue the condition any longer without attempting the experimental self-monitoring condition. In addition, these children had two to three different speech-language pathologists during baseline. With respect to experimental methodology this added a control for possible idiosyncratic effects of an individual speech-language pathologist.

During this stage, as in all conditions of the investigation, the children were given points that could be exchanged for functional reinforcers, chosen by the child prior to the start of the program.

Treatment With Self-Monitoring

At this point, although the children were demonstrating a high percentage of correct responses in the clinic, none of the children were evidencing any clear generalization of correct responding outside the clinical setting. Therefore, the children were all scheduled to receive

training in the following self-monitoring activities at their respective time in the multiple baseline design. See below for detailed information regarding the self-monitoring activity.

In order to be assurred that the children were self-monitoring, parents and/or teachers were randomly asked (weekly) if each specific child was actually monitoring during the self-monitoring program (i.e., producing the target sound correctly then recording it in the book). After the children reached their 90% goal, and began to fluently use their sound, they were allowed to stop using their self-monitoring books.

Reliability

Reliability measures were obtained for each child on the dependent variable (correct vs. incorrect productions of the target phoneme) during 60 randomly selected observations. Two observers naive to the experimental phase of the study, who were randomly selected from a pool of six observers, independently recorded correct or incorrect responses. Percent agreement was calculated on a point-by-point basis. This was done by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100 for each session. The average percent of agreement across the 60 sessions was 93.33% (Range: 40% to 100%).

Supplementary Subjective Evaluations by Teachers and Parents

In addition to collecting data through the use of a trained observer, subjective measures were also collected by asking the parents and teachers (either by a note, meeting, or phone) how the children sounded. Specifically, the parents and teachers were provided with the open-ended statement: "In order to assess the effects of the child's treatment, I would like to know how your child sounds in class (or at home)." Their responses were then coded as to whether the child was or

was not correctly using the target phoneme, in the opinion of the child's parents and teachers. These measures were also collected on a monthly basis as close as possible to the data points.

RESULTS

Children's Behavior

The results demonstrate that prior to the self-monitoring condition, there was negligible generalization. That is, very few children showed any type of generalization of the clinical gains regardless of the length of baseline (treatment without self-monitoring) measurements (Range: one month to three years). Then following the baseline sessions, after the self-monitoring activities were implemented, all of the children demonstrated increases in the use of the target sound outside of the clinical environment. The children consistently used the correct sound, 90% to 100% of the time, and continued to use the target sound correctly following the termination of the physical data sheets.

Teachers' and Parents' Subjective Judgements

The parents' and teachers' judgments corresponded very closely with the recorder's results. With the exception of two children, all of the other children were subjectively rated as incorrectly using their sounds before self-monitoring was initiated, and correctly using their sounds (either all of the time or part of the time) in the classroom and at nome after self-monitoring was initiated. Overall, the subjective reports were highly consistent with objective data, and lend support to the finding that the self-monitoring procedures facilitated generalization.

Replication

In order to assess the ease of replication of the present findings, a total of 27 children in 12 schools, in three school districts, with 5 different speech-language pathologists participated in a test of the

replicability of the results. Each of the replication therapists read the written instructions in a "How To" manual and were provided with the opportunity to ask questions over the telephone. The replication results showed that the 18 children successfully reached criterion and completed their involvement in the project, and the other 9 children were all making measurable improvements at the termination of the project.

Products

Tangible products produced at the end of the present project included: (1) a completed manuscript describing the project findings, to be submitted for publication in a professional journal; (2) a "How To" manual listing the detailed treatment steps developed in the present research; (3) the present final report; (4) an audio-visual training video tape to be used as an adjunct at professional workshops; (5) a presentation at the 1984 CEC Conference in Oakland; (6) presentations at the 1983 and 1984 American Psychological Association Conferences; (7) a presentation at Camarillo State Hospital; and (8) a presentation at the University of California, Santa Barbara.

RECOMMENDATIONS

Based upon the results of the present project, the following concrete recommendations can be made.

1) It is recommended that speech and language pathologists be aware of and understand generalization issues. The importance of the generalization problem is stressed by our baseline measurements which illustrate that even though the children performed their sounds correctly in the clinical setting, there was negligible improvement outside the clinic. Thus, classroom teachers and parents felt, subjectively, that the therapy was ineffective prior to the implementation of the self-monitoring program.

2) It is recommended that the children become more active participants in implementing their therapy programs through the use of self-monitoring activities since these activities rapidly solved the generalization problem.

3) It is recommended that the amount of in-clinic (out of classroom) time be reduced by implementing self-monitoring activities when the children have perfected the target sound to criterion up to the sentence level (see baseline steps).

4) In order to decrease clinician time it is recommended that the children be worked with in small groups of approximately 2 to 5 children.

5) Along with the above recommendations efficiency can be further increased by combining children with different speech sound target behaviors (e.g., s, z, and/or r) in single groups because the self-monitoring program is identical regardless of the target sound.

6) In order to implement these programs on as wide a scale as possible, it is recommended that the State Department of Education facilitate replication activities since the results of the present project suggest that replication should be readily achievable with minimal training intervention.

INTRODUCTION

Although a number of techniques and preconstructed programs have been used to effectively modify articulation, the behavioral changes these methods produce are often clinic-bound and limited to structured speech tasks. That is, generalization of a newly-learned response outside the clinical setting and/or into spontaneous speech is the most serious problem identified by most speech clinicians (Mowrer, 1971; Sommers, 1962; Wing & Heimgartner, 1973). The problem of generalization is an even greater obstacle for the speech-language pathologist in the public school system who often has a large case load, leaving little time for each child. Thus, a speech-language pathologist in the public school system typically pulls children out of the classroom for 15 to 30 minute sessions two or three times weekly for individual or small group treatment. Along with vacations, holidays, school absences, and walking to and from the classroom, very little time is actually spent with the children, and thus rapid generalization of the articulatory response into unstructured spontaneous speech does not frequently occur.

The literature yields some studies which offer promising suggestions, although few are methodologically very rigorous, and few published generalization studies have been conducted in the public school system. Some of the suggested methods can be programmed within the clinical setting. These include the use of overpractice with increased speech (Bankson & Byrne, 1972; Fitts, 1965), reducing differences between the treatment and natural environment (Stokes & Baer, 1977), the use of natural reinforcement or intermittent reinforcement (Stokes & Baer, 1977), and delayed (but contingent) reinforcement procedures (Fowler & Baer, 1981). Other methods which can be arranged outside of the clinical setting include the use of paraprofessionals (Costello & Schoen, 1978;

Galloway & Blue, 1975; Griffith & Craighead, 1972) and parents (Costello & Bosler, 1976; Raver, Cooke & Apolloni, 1978), and training in multiple environments (Griffiths & Craighead, 1972; Murdock, Garcia & Hardman, 1977). Although all of the above methods have been effective to some degree, they all have limitations when applied within the clinic setting in part because they are extremely time-consuming and therefore not practical for clinicians with large case loads.

However, one line of research seems especially promising in promoting generalization outside of treated environments. Recently, researchers have suggested that including the child as an active participant in the instructional program may promote generalization. For example, one suggestion has been to have children choose their own target behaviors (cf. Stokes & Baer, 1977). In addition, researchers have shown that self-monitoring can be very effective in improving behavior or making behavioral changes in handicapped as well as normal children (Engel & Groth, 1976; O'Brien, Riner & Budd, 1983; Rhode, Morgan, & Young, 1983; Rosenbaum & Drabman, 1979). However, even when self-monitoring of a newly-learned behavior is trained in order to promote generalization the self-monitoring itself typically does not generalize to other non-trained environments (cf. Drabman, Spitalnik, & O'Leary, 1973; Robertson, Simon, Pachman, & Drabman, 1979). Thus, it seems particularly important to also design a program where self-monitoring occurs in non-treated, natural environments in order for generalization and maintenance of the target behavior to take place (Rhode, Morgan, & Young, 1983).

In relation to the articulation literature, researchers have demonstrated that when children improve in the discrimination of their own correct/incorrect productions, improvements in articulation are

evidenced (Costello, Howard-Burger, & Graves, unpub.). That is, when children are trained and reinforced for distinguishing between their own correct vs. incorrect responses, spontaneous improvements in the child's articulation are evidenced. This should be differentiated from external auditory discrimination which occurs when the client discriminates another person's correct or incorrect articulatory responses or by listening to their own pre-recorded correct vs. incorrect responses.

Thus, it seems likely that training discrimination of correct vs. incorrect responses and then having the child self-monitor correct phoneme production in the natural environments should promote generalization. Therefore, the specific purpose of this project was to teach the children to discriminate their own correct vs. incorrect articulations; and then, to program self-monitoring of correct responses in the children's natural environments to promote generalization and maintenance of newly-learned articulatory responses.

STUDY APPROACH

Design

This study was conducted as a multiple baseline across subjects design (cf. Hersen & Barlow, 1976; Kazdin, 1982; McReynolds & Kearns, 1983) with the addition of a multiple baseline across phonemes. In a typical multiple baseline across subjects design, similar behaviors (i.e., correct speech sound productions) are first measured regularly over time in a baseline condition (Condition A) individually for a number of subjects. When baselines for all subjects are noted to be stable, the experimental treatment is introduced to the first subject (Condition B) while the other subjects remain in the baseline condition. Following the demonstration of a change in behavior (the dependent variable) in the predicted direction for the first subject, the experimental treatment (independent variable) is then applied to the behavior of the second subject, while the remaining subjects continue to be measured in the baseline condition. This process continues, each subject successively replicated in a baseline-treatment format. The multiple baseline design demonstrates that the treatment, rather than extraneous, uncontrolled variables, is responsible for changes in the subjects' behavior if each subject's behavior is changed when and only when the experimental treatment is introduced. Each subject, therefore, acts as a control for the preceding subjects by demonstrating that the behavior of interest does not change during baseline conditions, no matter their length, but changes only when the experimental treatment is introduced. Internal validity is strengthened each time the effect is replicated with another subject.

In this particular project the experimental phase was replicated across subjects with detailed monthly information presented on the first 13 subjects. At any point in this study, some of the children were receiving the experimental treatment, while the other children were remaining in baseline (as a control) to evaluate the treatment effect. In addition, 4 children have a multiple baseline across behaviors. That is, they had two concurrent baselines measuring two different behaviors. The treatment was implemented with one behavior while the other behavior remained in baseline. Thus by implementing the treatment at different times for different behaviors, increased assurance can be provided that the results were actually the effect of the experimental treatment.

Measurement

Because the experimental question in this study concerned generalization, all data points represent systematic generalization probes. That is, the dependent variable (percent of correct articulatory responses) was an independent measurement which was taken throughout the entire study. These data were taken both during the baseline condition, which consisted of the treatment without self-monitoring activities, and during the self-monitoring condition. Two observers naive to the experimental condition independently recorded the children's correct/incorrect productions during the children's speech. Observers were speech and hearing students who had completed a minimum of one course in phonetic transcription.

In order to obtain as valid a generalization measure as possible, this study attempted to collect data in the children's natural environments. Prior to the data recording probes, each child's teacher was introduced to the data recorders. The purpose of the measurement was explained to the teachers (but the teachers were not told how long the

baseline measures would be for any given child). The teachers were told that the recorders would make monthly checks. In addition, they were asked to introduce the data recorder as a new aide in the school who wanted some information about the school and wanted to meet some of the students. Therefore, it was hoped that the possibility would decrease that children would make an association with the data recorder and their speech, so that the data could be taken in a less clinical manner.

In order to obtain data during the child's unstructured spontaneous conversation, the data recorder engaged in a conversation with each child. During each of the child's responses, the first occurrence of the target phoneme in the child's answer was recorded as correct or incorrect. That is, the recorder made an utterance or asked a question, then the first target phoneme in the child's next response was recorded. Then, the recorder made a second utterance or asked a second question and the first occurrence of the target phoneme in the child's second response was recorded for the second response, and so on until ten responses were recorded. In instances where the target phoneme did not occur (such as if the child simply answered "no") that particular trial was disregarded. In order to record the responses unobtrusively, the data recorders covertly utilized each finger to represent a question. That is, the data recorders unobtrusively held their fingers in such a way (e.g., bent or straight) that they could later distinguish between the correct vs. incorrect responses. Then, immediately following the conversation, the responses were recorded on a precoded data sheet.

Baseline-Treatment Without Self-Monitoring Activities

As mentioned above, the baseline consisted of the treatment program without any self-monitoring activities for varying lengths of time. The specific steps are listed below.

PROGRAM STEPS

STEP 1: Train the target sound in isolation. (Also see Nemoy-Davis (1974) for further details on evoking consonant sounds).

A. The client imitates the sound after the speech clinician. In order to evoke the sound in isolation, visual and descriptive placement prompts may be necessary. Also, a mirror may be helpful for some clients. Twenty consecutive correct responses is the criterion for this step.

B. Spontaneous production of the target sound. The client must produce twenty consecutive correct productions of the sound in isolation without any model or prompts. In the case of final /r/ remediation, a combination of the various vowels + /r/ must be produced for a total of twenty consecutive correct responses. If a client misarticulates the /r/ sound in both initial and final word positions, the initial /r/ and final /r/ may be treated as separate sounds. The two separate /r/ sounds can be treated consecutively or concurrently. Voiced and voiceless cognates are treated as a single sound.

STEP 2: TRAIN THE TARGET SOUND IN WORDS.

A. Imitative production of words containing the target sound. Twenty to 30 pictures (without the written

word) containing the target sound(s) are used as stimulus items. When applicable, various word positions and cognates are used. The client is required to produce 20 consecutive different words to pass criterion. If the client is unable to produce the target sound in words, a branch step using the target sound in syllables may be used. Twenty consecutive correct responses is pass criterion. Fail criterion on the target words is five to ten consecutive incorrect responses.

B. Spontaneous production of the target sound(s) in words. The client is now required to produce the stimulus words (discussed in A above) without a model. Twenty consecutive correct responses is criterion.

STEP 3: Train the target sound in phrases.

A. Imitative production of phrases containing words with the target sound(s). Picture cards from step 2 (above) are used as stimulus items to evoke the phrases. The client produces the phrase after the clinician. At this point if another target sound should occur in the phrase, the client should produce it correctly. That is, from this point on the client is required to produce any occurrence of the target sound correctly during the speech drills. Twenty consecutive correct phrases is the criterion.

B. Spontaneous production of the above phrases. The client produces 20 consecutive correct phrases without a model using the stimulus pictures from step 2 (above). Again, the client is required to produce any occurrence of the target sound in the phrase correctly.

STEP 4: Train the target sound in sentences.

A. Imitative production of sentences with words containing the target sound(s). The clinician makes sentences using the target words. Then, the client repeats the sentences producing all target sounds in the sentence correctly. Twenty consecutive correct responses is criterion.

B. Spontaneous production of sentences containing the target sound(s). The client now makes up sentences about the target words, (discussed above). The client must produce 20 errorless sentences in a row to pass criterion. Once the client passes this step (s)he is ready to begin to self-monitor his/her speech.

Following the steps listed above the first group of children began the self-monitoring program. The children who did not enter the self-monitoring phase continued in the speech therapy program (as follows) without any self-monitoring activities. First, in the clinic room each child practiced the target sound in two sentences. Next, each child practiced the target sound in a variety of drills that required short responses from the child (e.g., describing a picture). At this point, as a control for practice outside of the clinic, speech drills were sent home for the parents to work on with children 12 and 13.

Finally, each child practiced the target sound in unstructured conversation.

Children 10, 11, 12, and 13 have extremely long baselines. These children were enrolled in speech services prior to the development of this specific self-monitoring treatment but had shown no gains outside of the speech therapy environment. After the program was developed all of the children continued in the baseline (treatment without self-monitoring) but no child remained in this speech program longer than four more months prior to starting the self-monitoring activity. Since no children showed any gains in this condition it seemed unethical to continue the condition any longer without attending the experimental self-monitoring condition. In addition, these children had two to three different speech-language pathologists during baseline. With respect to experimental methodology this added a control for possible idiosyncratic effects of an individual speech-language pathologist.

During this stage, as in all conditions of the investigation, the children were given points that could be exchanged for functional reinforcers, chosen by the child prior to the start of the program.

TREATMENT WITH SELF-MONITORING

At this point, although the children were demonstrating a high percentage of correct responses in the clinical setting, none of the children were evidencing any clear generalization of correct responding outside the clinical setting (e.g., in their classrooms). Therefore, the children were all scheduled to receive training in the following self-monitoring activities at their respective times in the multiple baseline design.

STEP 1: Train Internal Auditory Discrimination.

A. The speech-language pathologist demonstrates a correct vs. incorrect sound in a word. The pathologist tells the client that the incorrect --- sounds like ---, and a correct --- sounds like ---.

B. The client is required to produce a correct vs. incorrect sound. The speech-language pathologist now says a word containing the target sound to the client. (S)he then asks the client to say the word both the "correct" way then the "incorrect" way. That is repeated with several different words (three to five).

STEP 2: Train the Client to Record Correct Responses.

The client is now told that (s)he should say the sound correctly ALL of the time. Immediately following each correct response the client should mark a ( ) or a (+) on the data sheet. If the client is using a wrist counter (s)he should be trained to press the button immediately following each correct response.

A. Under supervision of the clinician, the child must demonstrate that (s)he can monitor approximately 20 correct responses during unstructured conversation. At this point, and the beginning period of B (below), the client's speech may sound very slow and labored. This is a natural phase before the sound becomes

"automatic."

B. Now the client is ready to begin monitoring his/her speech outside of the speech class. The client is told that (s)he must be involved in a natural conversation with another person or be reading aloud to another person. While talking, the client should record each correct sound immediately following the production. The data sheets or wrist counters should be carried (or worn) by the client as often as possible. Points may be exchanged for pre-determined reinforcers. Following this step most of the clients should be fully generalized (i.e., using their sounds at least 90% of the time during unstructured conversation outside of speech class) within one to two months. However some clients may learn their sounds as quickly as two to three weeks while a few may take considerably longer. When the client is beginning to use his/her sound in conversation (s)he will produce the sound more naturally as it becomes more automatic.

In order to be assurred that the children were self-monitoring, parents and/or teachers were randomly asked (weekly) if each specific child was actually monitoring during the self-monitoring program (i.e., producing the target sound correctly then recording it in the book). After the children reached their 90% goal, and began to fluently use their sound, they were allowed to stop using their books.

Reliability

Reliability measures were obtained for each child on the dependent variable (correct vs. incorrect productions of the target phoneme) during 50 (37.73%) randomly selected observations. Two observers naive to the experimental phase of the study, who were randomly selected from a pool of six observers, independently recorded correct or incorrect responses. Percent agreement was calculated on a point-by-point basis. This was done by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100 for each session. The average percent of agreement across the 60 sessions was 93.33% (Range: 40% to 100%).

Supplementary Subjective Evaluations by Teachers and Parents

In addition to collecting data through the use of a trained observer, subjective measures were also collected by asking the parents and teachers (either by a note, meeting, or phone) how the children sounded. Specifically, the parents and teachers were provided with the open-ended statement: "In order to assess the effects of the child's treatment, I would like to know how your child sounds in class (or at home)." Their responses were then coded as to whether the child was or was not correctly using the target phoneme, in the opinion of the child's parents and teachers. These measures were also collected on a monthly basis as close as possible to the data points plotted in Figure 1.

FINDINGS

..... Refer to Figure 1 here .....

Thirty-one of the 40 children who started in this study reached criterion well before the project period ended, and therefore successfully completed their involvement within this time period. The other 9 children, while still in progress at the completion of this

project, were all showing measureable improvement. Detailed monthly data for the first 13 children are shown in Figure 1. The results show that prior to the self-monitoring condition, there was negligible generalization. That is only one child (Child 9) showed any type of generalization of the clinical gains regardless of the length of baseline (treatment without self-monitoring) measurements (Range: 1 month to 2 years). Then following the baseline sessions, after the self-monitoring activities were implemented, all of the children demonstrated increases in the use of the target sound outside of the clinical environment. For example, Child 1 had no correct responses during baseline. Then, following the initiation of self-monitoring, she consistently used the correct sound, 90% to 100% of the time. In addition, she continued to use the target sound correctly following the termination of the physical data sheets. The same trend is evidenced for all of the other children. It is also interesting to note that while Child 5 was monitoring his first target sound no generalization to the second target sound occurred. However, once he began to monitor his second sound, generalization occurred.

Teachers' and Parents' Subjective Judgements

The parents' and teachers' judgments corresponded very closely with the recorders' results plotted in Figure 1. With the exception of Children 11 and 13, all of the other children were subjectively rated as incorrectly using their sounds (either all of the time or part of the time) in the classroom and at home. In the case of Child 11, the parents thought he sounded "better" after self-monitoring. However, while his teacher stated that he said his /s/ and /z/ correctly all of the time, she also stated that it sounded as if he had to make a conscious effort to produce the sound correctly, and it did not appear to be "automatic."

It is interesting to note that some of his gains did not appear to maintain over the summer, either (see Figure 1). In the case of Child 13, the teacher said she had not noticed any change in his speech over the year. However, his father, and three naive data recorders during the self-monitoring condition, in addition to his new teacher and the naive data recorder during the follow-up phase, felt that his speech no longer contained errors. Overall, the subjective reports are highly consistent with objective data, and lend support to the finding that the self-monitoring procedures facilitated generalization.

REPLICATION

The detailed results shown above are representative of the first 13 children who participated in this project. It is important to note, also, that the present project contained a replication component. In addition to the first 13 children (see Figure 1 and Table 1), 27 children were treated during the replication by speech-language pathologists both within and outside of the primary school district. These additional speech-language pathologists were provdided only with a rough draft of the "How To" manual, and the opportunity to ask questions over the telephone, in order to assess the ease of replication of the present results. It is noteworthy that 18 of the children in the replication sites reached criterion, successfully completing their involvement in the project, and that the other 9 children were all making measureable progress by the termination of the project period. Table 2 shows their sex, grades, and presenting problems.

CONCLUSIONS AND RECOMMENDATIONS

The results of this study, demonstrating that articulation improved after the children were trained to discriminate and self-monitor their correct articulations in their natural environments brings up important

clinical issues. In planning remediation programs, training the children to distinguish between their own correct vs. incorrect productions immediately following their own productions seems of primary importance (cf. Costello, Howard-Burger, & Graves, unpublished manuscript).

In addition, there seem to be several critical components which when used in combination appear to result in an effective self-monitoring program. These are listed below.

1. The client did NOT practice the target sound in a drill type manner such as simply repeating words or sentences with the target sounds, nor engaged in "artificial" conversations within the clinic (such as in the baseline treatment). Instead, the client used the target sound in natural speaking situations such as conversation and reading at home and at school. This type of treatment under natural conditions has been stressed as highly valuable with other populations (e.g., Hart & Risley, 1980) and seems like it may have been an influential component in the present package.

2. In the present study, correct responses were recorded by the child. That is, the responses were recorded on a sheet of paper or a wrist counter. In this way, it was easy for the clinician to check with parents and teachers to be sure that the children were indeed monitoring their speech. Observable behavior has been stressed as important for designing intervention programs and may have also been important in the present package.

3. In the present study self-monitoring was an activity which the children did in their natural environments. That is the client received rewards for self-monitoring (as opposed to just practicing as occurred in the baseline condition) conducted OUTSIDE of the speech training environment. This is important because the client already produced the target sound correctly in the speech environment when the speech-language pathologist was present. Monitoring within the speech room was simply to help assure that the children knew how to monitor accurately.

4. In the present study, random checks were made with significant others to be sure the child was indeed monitoring in the non-clinic settings. That is, the clinician checked with parents and teachers occasionally to be sure the child was actually monitoring during unstructured conversation and not simply marking points or repeating a word with the target sound in a drill type manner. Such validity checks have been stressed as important in helping to promote generalization (e.g., Rhodes, Morgan, & Young, 1983) and may have been helpful in the present package.

When the above components were implemented in combination the children showed very rapid improvements in generalization. In fact, by the time the first monthly measurement was made most of the children had already reached a high level of proficiency in their classroom. While this change seems extremely rapid, it is probably important to note that

subjectively it appeared to occur gradually during the month, rather than suddenly. Also, the initial productions appeared quite labored, and then gradually became more fluent throughout the month. Thus, while the package was extremely effective, it appeared to produce change in the typical manner characteristic of a learning curve, and that learning was quite likely taking place with the self-monitoring activity.

Overall, this package consisting of the above components, which were designed to promote generalization, was very successful in promoting both rapid generalization and maintenance of treatment gains. It was interesting to note that prior to the implementation of the self-monitoirng components, there was no change in the baseline measurements. This suggests that although the children were receiving competent speech treatment, in that they performed their sounds correctly in the clinic, the treatment was ineffective in promoting generalization to natural environments without the self-monitoring package.

Further research involving each individual component of this study would be interesting in order to evaluate the relative importance of each component and/or combination of components. However, it is hoped that, from a practical point of view, the present investigation will aid speech-language pathologists in the public schools in being able to systematically and predictably produce rapid generalized treatment gains for their public school clients, a goal which heretofore has been very difficult to achieve (cf. Mowrer, 1971; Sommers, 1962; Wing & Heimgartner, 1973).

Applied Research Design

One further point which might be important to comment on relates to the applied research design utilized in this investigation. Such designs (cf. Hersen & Barlow, 1976; McReynolds & Kearns, 1983; etc.) are

especially applicable in public school settings because they can be used in the context of systematically exploring likely treatment manipulations for individual children. No untreated control group is necessary, since each child serves as his/her own control, receiving all treatment conditions manipulated at systematically selected points in time for separate children. Further, the treatment which eventually turns out to be most effective is presented to all of the children. Thus, the design permits experimentally valid conclusions to be drawn for each individual child, and all of the children are able to receive tangible benefits from the research, making the design an especially valuable one for use in applied settings such as the public school system.

Recommendations

Based upon the results of the present project, the following concrete recommendations can be made.

1) It is recommended that speech and language pathologists be aware of and understand generalization issues. The importance of the generalization problem is stressed by our baseline measurements which illustrate that even though the children performed their sounds correctly in the clinical setting, there was negligible improvement outside the clinic. Thus, classroom teachers and parents felt, subjectively, that the therapy was ineffective prior to the implementation of the self-monitoring program.

2) It is recommended that the children become more active participants in implementing their therapy programs through the use of self-monitoring activities since these activities rapidly solved the generalization problem.

3) It is recommended that the amount of in-clinic (out of classroom) time be reduced by implementing self-monitoring activities when the children have perfected the target sound to criterion up to the sentence level (see baseline steps).

4) In order to decrease clinician time it is recommended that the children be worked with in small groups of approximately 2 to 5 children.

5) Along with the above recommendations efficiency can be further increased by combining children with different speech social target behaviors (e.g., s, z, and/or r) in single groups because the self-monitoring program is identical regardless of the target sound.

6) In order to implement these programs on as wide a scale as possible, it is recommended that the State Department of Education facilitate replication activities since the results of the present project suggest that replication should be readily achievable with minimal training intervention.

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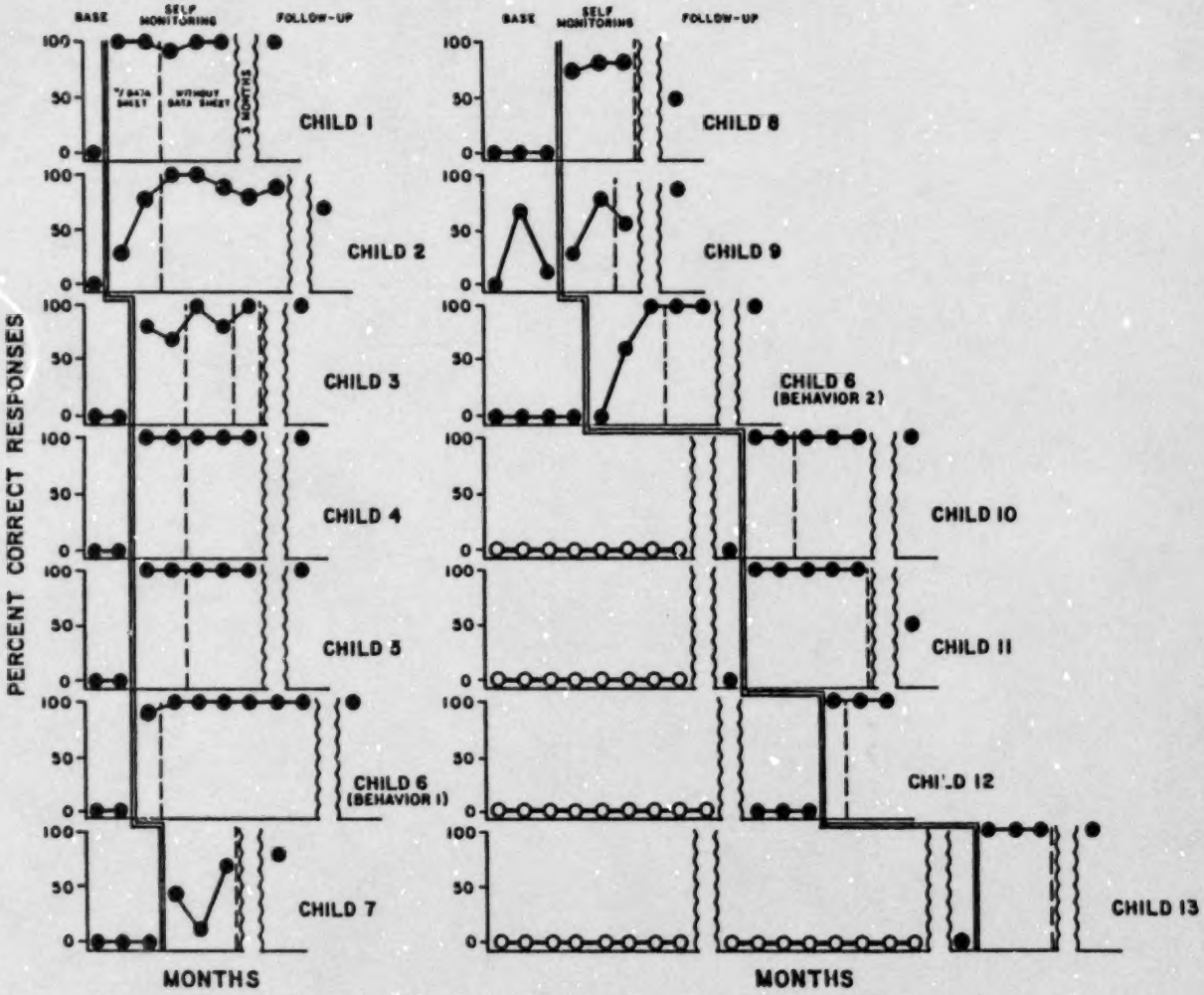
FIGURE CAPTION

Figure 1. Figure 1 shows individual data for the 14 behaviors. Percent of correct responses is plotted on the ordinate and the months are plotted on the abscissa. Hollow dots represent estimates obtained by previous speech-language pathologists prior to the development of the current self-monitoring treatment. Double lines represent the initiation of the self-monitoring. Dotted lines show when the child was carrying the physical data sheets and breaks represent 3 month periods without any type of treatment (i.e., summer vacations).

Figure 2. Figure 2 shows group averages for the first 13 children. Percent of correct responses for the group are plotted on the ordinate. The abscissa shows baseline measurements. Data for the first 3 months of the self-monitoring phase, and follow-up measurements.



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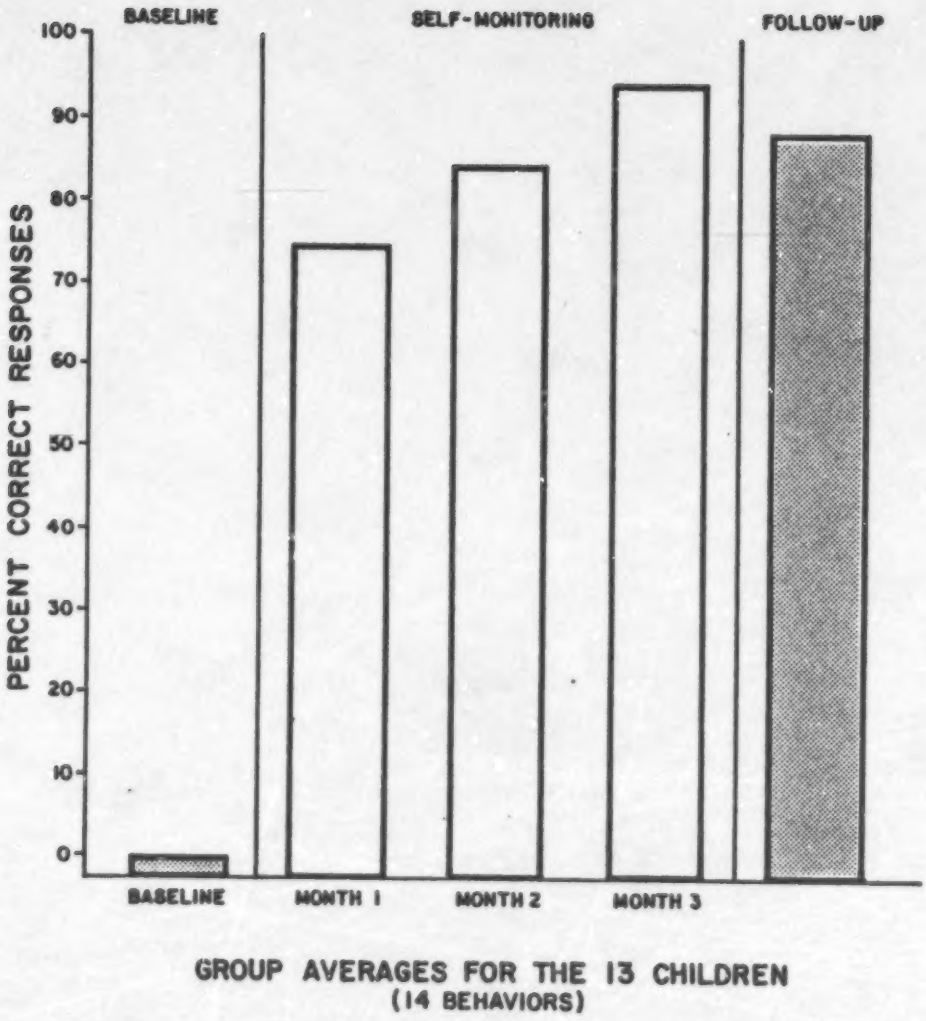

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Table 1. The age, sex, target sound(s) and treatment format for the first 13 children in the investigation

Child	Sex	Group (G) or Individual (I) Treatment	Grade	Age at Start of Study	Target Error Sound(s)
1	F	G	3	7;9	[s,z] dentalized
2	F	G	3	8;7	[s,z] dentalized
3	F	G	2	7;10	[s,z] dentalized
4	M	G	2	8	[r] w/r
5	M	G	2	8;6	[r] w/r
6	M	I	2	7;10	[s,z] dentalized [r] w/r
7	F	G	2	7;1	[s,z] dentalized
8	M	I	4	10;9	[s,z] lateralized
9	F	G	2	7;2	[s,z] dentalized
10	F	G	2	7;9	[s,z] dentalized
11	M	I	2	8;3	[s,z] lateralized
12	F	I	1	6;6	[r] w/r
13	M	G	2	7;3	[s,z] dentalized

Table 2. The grade, sex, target sound(s) and replication site for children in the replication sites

	Child	Sex	Grade	Target Sound(s)	Status at end of project yr
Site #1	14	F	2	[s,z] dentalized	**
	15	M	2	[s,z] lateralized	*
	16	F	2	[r] w/r	**
	17	M	2	[s/z] dentalized	**
	18	F	2	[r] w/r	**
	19	M	2	[s,z] dentalized	*
	20	M	2	[sz] dentalized [r] w/r	** [s,z] *[r]
	21	M	3	[s,z] dentalized	**
	22	M	6	[r] w/r	**
	23	F	2	[s,z] dentalized	*
Site #2	24	F	2	[s,z] dentalized	**
	25	F	2	[s,z] dentalized	*
Site #3	26	F	6	[s,z] dentalized	**
	27	F	7	[s,z] dentalized	**
	28	F	4	[s,z] dentalized	**
	29	F	4	[s,z] dentalized	*
	30	M	3	[s,z] dentalized [r] w/r	*
	31	M	3	[s,z] dentalized	**
	32	M	2	[s,z] dentalized	**
	33	M	4	[s,z] dentalized	*
	34	M	3	[s,z] dentalized	*
Site #4	35	M	2	[s,z] dentalized	**
	36	M	3	[r] dentalized	**
	37	M	3	[r] dentalized	**
	38	M	3	[s] dentalized	*
	39	M	3	[s] dentalized	**
	40	F	3	[r] dentalized	**

* in progress but showing measureable improvement
** successful completion